REMARKS

Claims 2 and 8-26 are canceled. Claims 27-39 are newly added; however, no new matter is added and all features recited in the newly added claims 27-39 are fully supported by the specification and drawings, as filed. Therefore claims 1, 3-7 and 27-39 are all the claims pending in the application.

Claims 1-7 stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion.

I. The Prior Art Rejections

Claims 1-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Edwards, et al. (U.S. Patent No. 5,819,402), hereinafter referred to as Edwards, in view of Daves, et al. (U.S. Patent No. 6,091,603), hereinafter referred to as Daves. Applicants respectfully traverse these rejections based on the fact that Edwards and Daves not only do not teach or suggest the desirability of the combination, but rather Edwards and Daves teach away from such a combination. Additionally, the cited prior art references in combination, do not teach or suggest the following claimed features of the invention: (1) "a plurality of heat spreaders having different thicknesses", and (2) "a heat dissipating structure having a flat base".

More particularly, the claimed invention, as described in paragraphs [0031-0034] of the specification, comprises a "plurality of heat spreaders that have different thicknesses". Each of the heat spreaders is connected to a corresponding one of the integrated circuit chips. A heat dissipating structure (i.e., a thermal lid) with a "flat base"

is connected to the upper sides of the heat spreaders through a thermally conductive material (e.g, a thermal grease). The thermally conductive material is positioned in gaps between the upper sides of the heat spreaders and the flat base of the lid. Since different chips may produce different amounts of thermal energy, the heat spreader that is connected to the chip that produces the most thermal energy is thicker than other heat spreaders in order optimize cooling. Consequently, the smallest of the gaps exists between the top of the thickest heat spreader (i.e., the heat spreader that is connected to the chip that produces the most thermal energy) and the flat base of the heat dissipating structure.

Therefore, the claimed invention efficiently accomplishes preferential heat dissipation, by not only varying the size of the gap (and hence the thickness of the thermally conductive material) between the lid and the chip, but by providing heat spreaders with different thicknesses (and optionally, made of materials with different coefficients of thermal conductivity) in combination with a lid with a flat base (i.e., a lid not requiring customization for each package). Additionally, the thickness of the heat spreaders used in the invention can be carefully selected based on heat spreader and assembly manufacturing tolerances such that the top surface of the high-power heat spreaders is unconditionally higher than that of the other low-power heat spreaders. This design allows higher performance adhesives and higher conductivity (and higher cost) heat spreaders to be used for high-power chips, while other lower cost adhesives, other thermal interface materials and lower conductivity (and lower cost) heat spreaders can be used for the low-power chips that do not require the same cooling capacity.

Contrarily, Edwards and Daves each teach customized thermal lids for heat dissipation and, particularly, customized thermal lids that, considered in their entirety, teach away from each other and from the claimed invention. Thus, there is no explicit or implicit motivation for combining and modifying the cited prior art to produce the claimed invention.

Specifically, Edwards teaches a thermal lid that is customized to accommodate the thermal dissipation requirements for different chips (see column 6, lines 52-55). The thermal contact areas are recessed to different depths depending on the dissipation requirements of the corresponding chip (see column 6, line 55- column 7, line 5; see also Figures 2-3). Thermal fluid such as thermal oil, paste, grease, etc. fill the differing sized gaps (recesses) between the chips and the lid (see column 7, lines 1-18, see Figures 2-3).

Daves on the other hand teaches a lid with solid customized understructures designed to reduce the amount of compliant, thermally conductive, material in the primary heat dissipation paths between a chip and the lid (see Abstract). Specifically, a plurality of customized understructures extend from the underside of the Daves lid and provide a plurality of chips with separate heat dissipation paths to the lid (see column 4, line 65- column 5, line 7). The solid customized understructures, with optional shims, are each designed to reduce the thickness of the thermally conductive compliant material (e.g., thermal paste or grease) in the heat dissipation path between the chip and the lid to preferably 4-6mils (see column 5, lines 25-37 and column 6, lines 50-58).

In summary, Edwards teaches a lid with customized recesses that allow for varying thicknesses of compliant, thermally conductive, material between each of the

different chips and the lid. This is directly opposite of Daves which teaches a lid with customized solid extensions that allow preferably only a thin (e.g., 4-6nm) compliant, thermally conductive, material between the different chips and the lid, regardless of the heat dissipation requirements for the different chips. Given that these cited references teach directly away from the claimed invention (which teaches a non-customized lid with a flat base) and directly away from each other (recesses for vary thicknesses of thermally conductive material vs. solid understructures for thin thermally conductive material), there would be no motivation to combine the cited prior art to produce the claimed invention.

Additionally, as mentioned above, even if combined neither Edwards nor Daves, teaches or suggest the following the features of the invention: (1) "a heat dissipating structure having a flat base", and (2) "a plurality of heat spreaders having different thicknesses".

Regarding the heat dissipating structure having a flat base, both Edwards and Daves provide customized lids (i.e., heat dissipating structures) with bottom surfaces that are particularly not flat in that they have recesses and extensions, respectively. The claimed invention necessarily requires a flat base so that the size of the gaps and, thus, the thickness of the thermally conductive material, are a function of the thickness of the heat spreaders. For example, the smallest of the gaps exists between the top of the thicker heat spreader (i.e., the heat spreader that is connected to the integrated circuit chip that produces the most thermal energy relative to the other integrated circuit chips) and the flat base of the heat dissipating structure.

Regarding the heat spreaders with different thicknesses, the Office Action cites Daves as disclosing the feature of heat spreaders and indicates that it is a well known fact that the thickness and the material of a heat spreader affects thermal conductivity. Thus, the Office Action concludes that it would have been obvious to a person of ordinary skill in the cooling art at the time the invention was made to provide said heat spreaders of the Edwards-Daves combination with different thicknesses and different coefficients of thermal conductivity, in order to achieve the desired thermal coupling between each particular semiconductor chip and the heat dissipating structure. The Applicant's, however, respectfully disagree because while Daves teaches the use of heat spreaders and while it is known that varying the thickness of a heat spreader effects thermal conductivity, both the Daves and Edwards structures generally do not allow for heat spreaders with different thicknesses.

For example, since the understructures of the Daves lid are customized to ensure that only a thin (e.g., 4-6nm), compliant, thermally conductive material is between the chip and the lid, varying the thickness of the heat spreaders from chip to chip would negate the purpose of the customized lid. Similarly, since the recesses of the Edwards lid are each customized to have particular depths designed to optimize heat dissipation for a corresponding chip, adding heat spreaders onto each chip and then varying the thickness of heat spreaders from chip to chip would negate the purpose of the customized lid.

Therefore, independent claim 1 and newly added independent claims 28 and 35 are patentable over Edwards in view of Daves. Furthermore, dependent claims 3-7 and 27 which depend from claim 1, dependent claims 29-34 which depend from claim 28, and

dependent claims 36-39 which depend from claim 35 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define.

Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion

With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims.

In view of the foregoing, Applicants submit that claims 1, 3-7, and 27-39 all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any

deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0458.

Respectfully submitted,

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